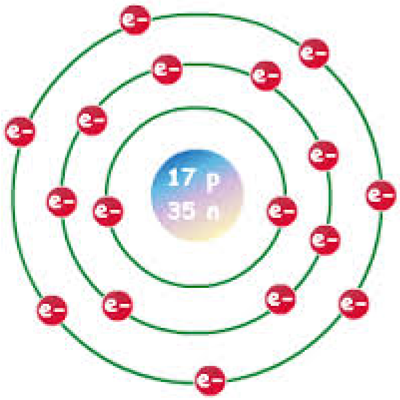
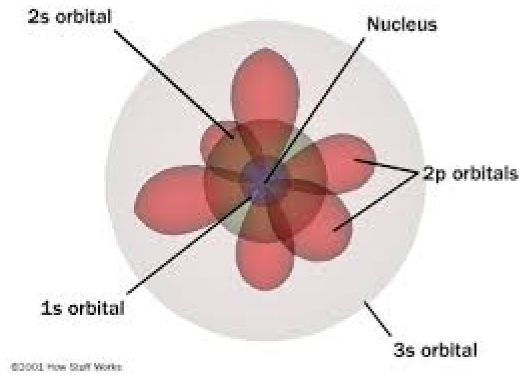
Name: ____________________ **Per:** _____

Orbital Diagrams and Electron Configuration WS



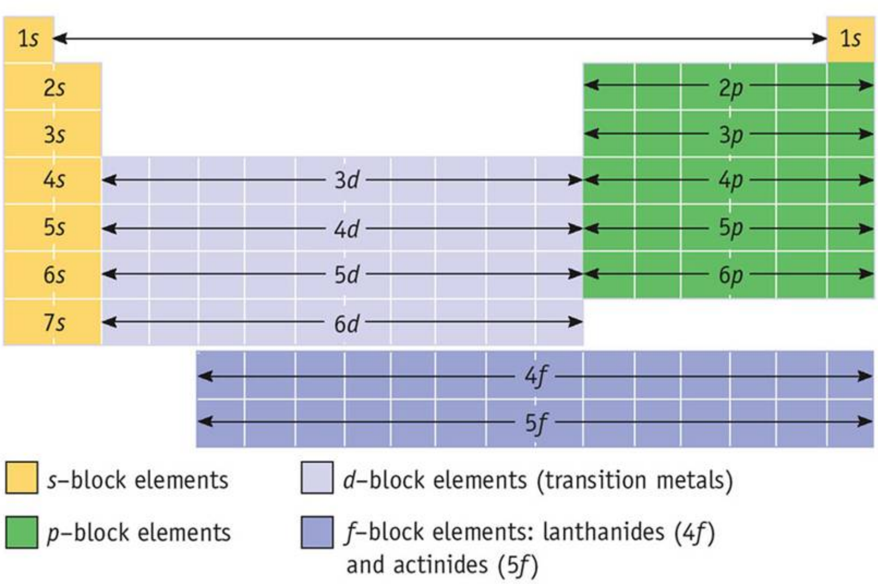
Bohr Model



Schrodinger Model

Many scientists have contributed to the model of the atom over time. The last person discussed was Niels Bohr who said that electrons orbit the nucleus like planets orbit the sun. He said that the orbits or "shells" which the electrons are found in are a fixed distance away from the nucleus and that only a specific number of electrons belong in each orbit.

Bohr was on to something when he came up with these orbits, but he was not completely correct in his thinking and his model of the atom was improved by Erwin Schrodinger. Schrodinger used mathematical equations to determine regions of space in which electrons were found 90% of the time. These regions of space are called **orbitals** and each orbital can hold a **maximum of two electrons**. The electrons move freely within the orbital in an unfixed path. The orbitals make up sublevels or subshells and the sublevels make up energy levels. In the image below you can see the periodic table broken up into different sections. The number in front of the letter is associated with an energy level, the letter is associated with a sub level. There are a total of 7 energy levels made up of S, P, D and F sub levels. Each S, P, D and F sub level are made up of orbitals that can hold two electrons.



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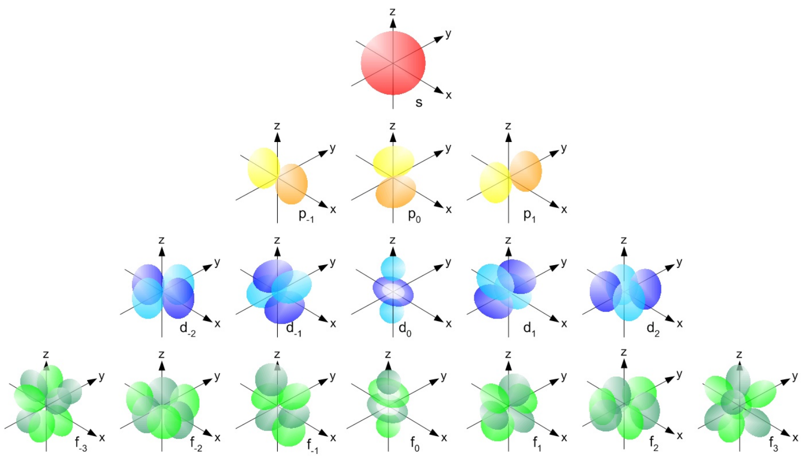


S orbital shape = sphere

P orbital shape = dumbbell

D orbital shape = 4, 4 leaf clovers and 1 double sided pacifier

F orbital shapes = vary

Each period (row) = **principle energy level**, or **shell**

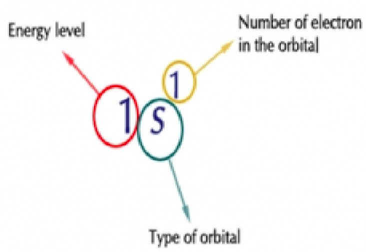
Each block (s,p,d,f) = **sublevel**

s sublevel = holds a maximum 2 electron, 1 orbital (2 electrons per orbital)

p sublevel = holds a maximum 6 electrons, 3 orbitals (2 electrons per orbital)

d sublevel = holds a maximum 10 electrons, 5 orbitals (2 electrons per orbital)

f sublevel = holds a maximum 14 electrons, 7 orbitals (2 electrons per orbital)



To determine the electron configuration for an element, one can simply "read" the periodic table. First identify the energy level (1-7), the sublevel (s,p,d,f) and then count the number of squares into the sublevel to determine how many electrons are in that sublevel.

For example: the electron configuration for **Na, sodium with 11 electrons (reading left to right on the periodic table):**

Always start at hydrogen in the s block, we would fill the 1st energy level, s subshell (s sublevel can only hold 2 e-) = $\mathbf{1s^2}$

Moving to the next row with lithium in the s block, we fill up the 2nd energy level, s subshell (s sublevel can only hold 2 e-) = 2$\mathbf{s^2}$

Moving to the p block now-still second period, we fill up the 2nd energy level, p subshell (p sublevel can only hold 6 e-) = $\mathbf{2p^6}$

Moving to the next row and **ending with sodium** in the s block, we only fill up the 3rd energy level, s subshell with 1 electron (**because sodium is the first square in 3s**) = $\mathbf{3s^1}$

electron configuration for Na, sodium with 11 electrons = $\mathbf{1s^2\ 2s^2\ 2p^6\ 3s^1}$

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** To double check your work, the sum of your superscripts should be equal to the total number of electrons**

Another example is Chlorine, Cl: $\mathbf{1s^2\ 2s^2\ 2p^6\ 3s^1 3p^5}$

Write the complete electron configuration for the following elements:

1) Li:
2) P:
3) Ca:
4) Fe:
5) Br:

The electron configuration can be used to fill in orbital diagrams. Orbital diagrams are an easy to read version of orbital drawings which can get extremely messy. When filling the orbitals, electrons follow certain rules in how they fill, they are:

- Fill sublevels from lowest energy to highest energy
- Each orbital in a sublevel must have 1 electron before any orbital in that sub level can hold two electrons
- Each orbital should have an electron with first an up spin electron and then a down spin electron

(An up spin electron is simply an arrow pointing up, and a down spin electron is an arrow pointing down)

Here is an example for Zinc (pay special attention to the order of the energy levels and sublevels, they fill from low energy to high energy and are not in numerical order):

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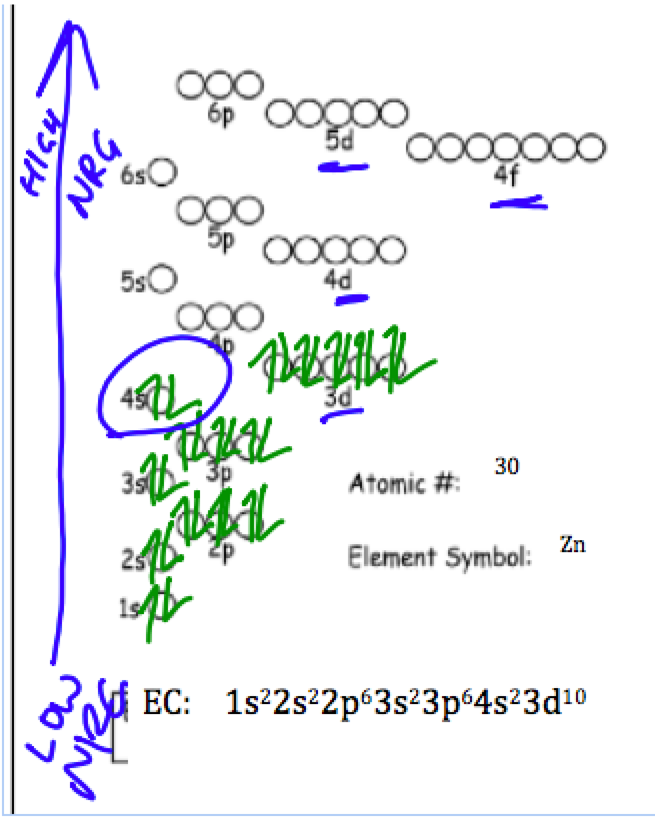
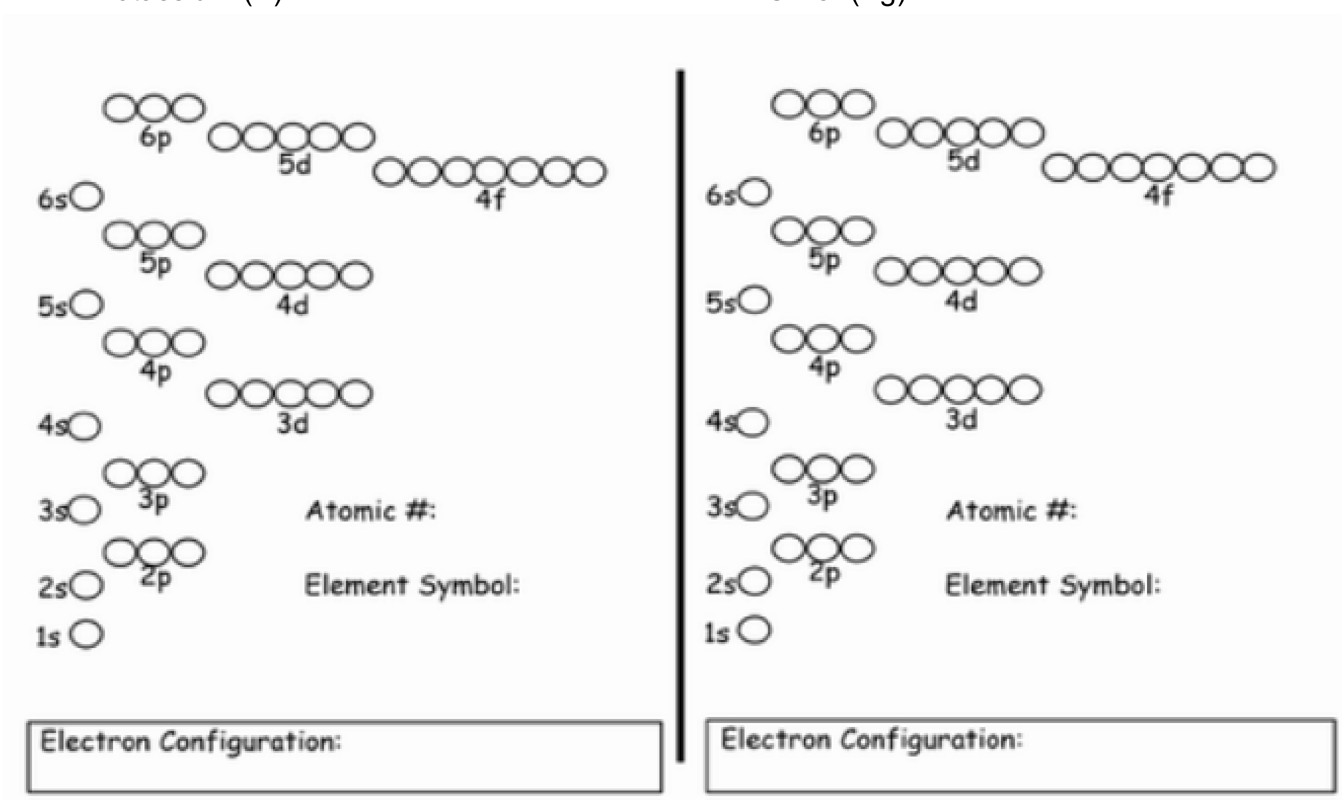


Fill in the orbital diagrams for

Potassium (K): Silver (Ag):



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Fill in the venn diagram showing similarities and differences between orbits and orbitals:

Orbits Both Orbitals